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THE EVOLUTIONARY PROBLEM AS IT IS TODAY

BY

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TO MY FRIEND

HENRY CARR, LL.D.,

OF THE COMMUNITY OF ST. BASIL

A SMALL RECOGNITION OF MANY KINDNESSES

AUGUST, 1927

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THE EVOLUTIONARY PROBLEM AS IT IS TODAY

CHAPTER I

There is a Problem

Is it necessary to say that there is a problem? Perhaps it is, for there are some who seem to be surprised that such a subject as evolution should be debated or even raised. Such altogether misunderstand the rôle of science, which is to seek out a complete explanation of the universe, if that be possible, by natural laws—of which more in a moment. The scientific man is not merely at liberty to carry, but he must carry his probe of any question which comes before him to the limit. He need not even assume—in so far as he is working on purely scientific lines—that there is anything to prevent him from finally arriving at a complete explanation of the universe. Of course, he knows very well that he cannot do anything of the kind. Michael Foster said of his lifelong friend Huxley that "great as he felt science to

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be, he was well aware that science could never lay its hand on, could never touch even with the tip of its finger, that dream with which our little life is rounded." This is at least a clear admission that science cannot explain everything.

Even when he talks of "natural laws," the scientist should be, although he is not always, quite clear that his natural law is not—as one would almost imagine from some statements that it was—a thing preëxistent to the phenomena which it classifies, and, in fact, the thing which causes and arranges those phenomena and the order in which they appear. The scientific man begins by trying to discover new facts (the making of bricks); he goes on to classifying his facts and arranging his objects in categories (the sorting out of the bricks); and then turns to the erection of his building by making a theory, usually a working hypothesis by means of which the idea he has may be tried out. That is all right, as long as he (or, far more often, someone for him) does not claim that this hypothesis is a scientific fact.

Someone has said that we should not adopt theories as creeds and denounce someone else's theories as heresies. There is a natural tendency to do both, but the former is far more deadly than the latter. As long as we recognize that a man is merely setting up a working hypothesis as a kind of scaffold on which to extend his ideas, there can be no reason why he should not carry on to the limit. Any

assumption can be made in philosophy, provided that it is understood that ultimately it will have to be proved. If Galileo had understood what was meant by a working hypothesis, there would not have been all the trouble that there has been over him. There is also the counsel of despair to be taken into consideration: "All that I know is that nothing can be known." Fabre, described by Darwin as "that inimitable observer," was inclined to take that line when he said: "Scientifically considered, nature is a riddle to which human curiosity can find no answer. Hypothesis follows hypothesis, the ruins of theories are piled one on another, but truth ever escapes us. To learn how to remain in ignorance may well be the final lesson of wisdom." [1] That is not the general attitude of science, which is to press on to the attempt to unify all things. In that course we arrive at the problem for the solution of which evolution, as it is commonly called, is put forward.

It is a thousand pities that that theory has ever come athwart the hawse of the ship of religion. But it has, and hence these papers. Professor More[2] says that "the clergy have made the profound mistake of not realizing that they are not concerned with the scientific doctrine of biological evolution." And he continues: "It should make no difference to them whether corporeal man was created by a special act

[1] "Souvenirs Entomologiques," Ser. III, p. 317.
[2] "The Dogma of Evolution."

of God, or whether he is linked to the rest of organic beings." Of course, he does not advert to the fact that the clergy were bound to concern themselves with this matter, as soon as the hypothesis was used as an argument against the truth of the Bible. It must be admitted that, in the inception of the quarrel, some of the theological opponents were the worst enemies of the cause they were attempting to support—Samuel Wilberforce, to wit, as the most prominent example. The contest did harm in many ways, for it led to the idea that every shape or form of the evolutionary hypothesis was flatly contrary to all religious ideas; and it led also to the use of arguments on the scientific side, which, whilst apparently effective against the adversaries at the moment, were not such as would have been used in ordinary cool discussions.

The heat and folly of the controversy is in no case better illustrated than in that of Mivart, who was the only person on the orthodox side to take the position that a moderate form of evolution was in no way incompatible with religion. The reward which he got was a violent attack from Huxley, who attributed his scientific criticisms—which have stood the brunt of controversy from that day—to religious bias, and held that his religious *eirenicon* was useless, since it was not in accord with what Huxley took to be Catholic teaching. "When a scientific theory is brought before us, our first inquiry is not whether it

is consistent with religion, but whether it is true. If it is found to be true on the principle of the induction of Bacon, it will be found to be consistent with religion on the principle of the unity of knowledge." [3] Excellent doctrine and Catholic teaching too, though the man who uttered it was not of our livery. At any rate, there is a problem. What is it?

[3] McCosh.

CHAPTER II

The Problem

I will try to set the problem in its simplest form. We are confronted by a vast variety of living things, animal and vegetable. This vast array is of a discontinuous character. It is divided into animals and vegetables, of course, and, omitting the lowest grades, there is no difficulty in saying which is which. Further, in these kingdoms there is also discontinuity, so that there is no difficulty, for example, in distinguishing between a dog and a cat, though both are carnivora and, so to speak, first cousins. The fact is, that one species does not fade slowly into another species, like the old "dissolving pictures" of the magic-lantern. Or, to vary the metaphor, the picture of life is not that of a gentle slope but a series of steps. It is necessary to insist on this discontinuity, for, though very obvious when mentioned, it is not always adverted to, and is a most important item in the discussion. Then again, in the past geology reveals to us a picture of vast complexity, though in the earlier days it was less vast and only gradually became as complicated as it now is. And it is a dis-

continuous picture always. This growing complexity naturally means that quite new forms were from time to time making their appearances. There were no creatures with backbones at one time; then fishes appeared. There were no animals with legs; then amphibians appeared. There were no mammals for a long time; then they appeared. Further, there were extensive races which disappeared. In the early seas there were hosts of trilobites (things akin to the king-crabs of to-day); they are all gone these millions of years, so the geologists say. There were enormous lizards at one time (like the *Diplodocus* whose skeleton is at Pittsburg), eighty and more feet in length; all are gone, leaving only our little lizards of today to represent them. These facts make up the problem, and running through it are two factors which we know to exist, though we know little more about them—namely, heredity and variation. Like does produce like, yet not quite identical progeny. A duck does not come out of a hen's egg, nor is a pig born in a carefully kept kennel of cocker spaniels. Yet absolute identity does not exist; there is the factor of variation, and sometimes the variation may be considerable. How is all this to be accounted for—that is the problem, and the answer today is by evolution. That is the point to be inquired into in these papers, and in that inquiry I intend to set down all the salient points of the long-drawn controversy, and show how it stands today, emphasizing

as we go along the really strong points of the theory—for it has such of course, in spite of a few rather ignorant people's quite unwarranted statements. At the same time I shall also set down the various difficulties, which are much greater again than heated advocates of the theory allow. In fact, the object will be to set forth a plain statement as to how the theory stands today.

CHAPTER III

Evolution as the Key to the Problem

Since Darwin was the "onlie begetter" of latter-day evolutionary theories at any rate, his well-known passage concluding the "Origin of Species" may once more be set down: "There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most wonderful and most beautiful have been and are being evolved."

That passage is familiar to all students of the question, but even some of them may be unaware that in the original draft the words "perhaps into only one" were added in pencil.[3] In their modified form they appear as above, and show that to the end of his days the author felt uncertain as to whether evolution was mono- or poly-phyletic (that is, whether all living things were descended from a single or from a variety of stocks). The emergence of the rest of the passage from the original drafts is also interest-

[3] "Foundations of the Origin of Species," 1909, p. 254, n. 4.

ing, as showing the state of Darwin's mind at the inception of the theory. "It accords with what we know of the law impressed on matter by the Creator, that the creation and extinction of forms, like the birth and death of individuals, should be the effect of secondary [laws] means." [4] And again, speaking of the vastly complicated laws required thus to produce living things: "The existence of such laws should exalt our notion of the power of the omniscient Creator." [5] Darwin himself admitted, and indeed it is evident throughout his works, that he could not understand a philosophical argument, and later in life he became more than nebulous in his religious views; but the passages quoted show that, had he come under influences different from those which actually determined his trend of mind, there was no reason why his theories might not have been developed along lines acceptable to Christian teaching, as indeed Mivart clearly saw.

To develop the original quotation, the theory of evolution or transformism (a better title) teaches that life appeared in certain unicellular organisms; that these became multicellular and thus organized beings; that, by degrees, from these arose all the living things which we see around us, and of course those which have existed in past times. Thus, to take the animal kingdom, things with backbones de-

[4] *Op. cit.*, p. 51.
[5] *Op. cit.*, p. 52.

veloped from others which were unprovided with such, and things with limbs came from fishes, which again had nothing nearer to them than fins. To that minimum exposition of the theory all evolutionists of all categories would subscribe, and in substance it goes back far into antiquity. I am certainly not going to urge that St. Augustine taught a doctrine patient of this explanation, since, having carefully studied the various works on that subject by men who know far more about it than I do, I am being led to the conclusion that it is not possible to know exactly what the Saint really did mean. But at any rate, in 1675, Athanasius Kircher, S.J.[6]—"Doctor Centium Artium," as he was called—expressed his opinion that our modern species had originated by transmutation within definite series of forms, and was the first amongst the moderns to start an idea which is now so much debated, and which, at least as stated above, holds the field, since there is no rival theory. Therein lies its great strength, for the late Yves Delage, who was a really distinguished writer on biological questions, said that "if there existed some other scientific hypothesis besides that of descent to explain the origin of species, many transformists would abandon their present opinion as not being sufficiently demonstrated."[7] It was for

[6] "Arca Noe in Tres Libros Digesta," cfr. Wasmann, "Modern Biology," p. 276.

[7] "L'hérédité et les grands problèmes de la Biologie Générale," p. 204.

this reason that Bateson said that we had got to believe in evolution, meaning that there was no other theory to consider in comparison with it. Bateson's attitude is very clearly shown in a remark by Professor Morgan of Columbia University in a recent article in *Science,* where he speaks of his "assuming that the doctrine of descent is true in the main *because of the difficulty of forming any alternative hypothesis as good.*" I have italicized these words, because they sum up one of the main arguments of these papers. Evolution is not a proved fact, but holds the field for want of any better theory.

It will of course be understood that I am speaking from the purely scientific standpoint, and expressing the ideas of modern scientific books. But, if there is agreement on the outline set down above, there is the widest difference of opinion on every other point, as will be made abundantly clear in these chapters. A few points in that connection must be set down in this section.

Is it a proved fact?

Every one of the innumerable little manuals will tell you it is, and even real authorities, like Professor de Dorlodot of Louvain, would agree; yet, you have Professor Millikan of Chicago, a scientific star of great magnitude, declaring that it is pathetic to see men of science trying to prove evolution, a thing which in his opinion never can be proved. He is a

physicist and not a biologist, and I take it that he means that such proof can only be experimental, which in his opinion is not possible. As far as supplemental proof in the way of the derivation of one species from another goes, there simply is none—a matter also to be dealt with further. "It must be acknowledged that the formation of one species from another has not been demonstrated at all." [8] Bateson agrees that proof must be experimental, and that it depends on our understanding of the hereditary mechanism, which is a thing that we have only begun to grasp since Mendel showed us how to do so.

Hogben [9] says that the theory is still in its infancy, but is becoming more and more the nucleus of a living body of experimental investigation, and so it is, but so far the crucial test of the development of a new species is nowhere to be seen, and thus the evidence is purely circumstantial. That is by no means enough to *prove* the truth of the theory, however strongly it may suggest it. In 1903 Professor Morgan of Columbia University [10] said that "however probable the theory may appear, the evidence is indirect and exact proof is wanting"; and that to my mind sums up the answer to this first question with complete accuracy today.

[8] Delage, *op. cit.*, p. 322.
[9] *Discovery*, June, 1924.
[10] "Evolution and Adaptation," p. 57.

What about "one or more forms"?

There is no very vigorous controversy on this head, for, though no doubt there is or perhaps was a kind of underlying idea that the original living cell diverged into animal and vegetable branches respectively, and thence each in its several ramifications led to what we find around us, biologists as far apart as Bateson and Wasmann have declared their adhesion to the polyphyletic idea, which envisages a variety of starting-point cells, though, it must be admitted, without any very definite light on details. [11]

What was the method of this evolution?

Here it is not too much to say that the whole position is one of chaos. A witty reviewer in the *Times Literary Supplement,*[12] London, envisaged the battleground of evolution, where there are "Darwinians and neo-Darwinians (what a name!), Lamarckians and neo-Lamarckians, Galtonians, Haeckelians, Weismannians, de Vriesians, Mendelians, Hertwigians, and many more whom it would be tedious to enumerate." That most of these remain embattled, we shall see later, and the critic exclaimed with some truth that "this is *science,*" not "the weakness of the theologians or the metaphysi-

[11] This matter with other problems is well discussed in "Études sur le Darwinisme," in *Rev. de Philosophie,* Sept.-Oct., 1910.
[12] June 9, 1905.

cians who stumble about in uncertainty, obscurity and ignorance!"

There is a certain triumphant tone about the critic which leads one to suppose that he was not himself a biologist; but none the less what he says is perfectly true, though he does not tell us that it is also inevitable in the ever-changing kaleidoscope of scientific discoveries and experiments. The Victorian age had not learnt the bitter lesson that the "best laid" theories "gang aft agley." That was the discovery of a later date, and accounts for the scientific skepticism which Sir Oliver Lodge tells us has succeeded the certitudes of the time when Huxley was consul. One fact, however, emerges most clearly from all this, and it is as follows: to talk of a theory as being *proved* about which there is such utter confusion, is to use that term in a non-natural sense. A thing is proved when the rejection of the idea is obviously absurd, and that is not the case here. In point of fact, how can it be said to be proved until we have some clear idea—which today we have not—as to how animals and plants have evolved?

CHAPTER IV

The Idea of Species

Everybody thinks that he knows what he means when he speaks of such and such a species, but in reality it is no easy matter to define the term. Bateson says that it is "morphological discontinuity and interspecific sterility," and that definition will serve. For our purposes it will be sufficient to say that, whilst occasionally fruitful congress between creatures of different species is possible (though that is rare), the products of such congress are invariably sterile, the mule and the jennet being examples familiar to all. But for that sterility, how difficult it would be to come to a decision in many cases! If we knew nothing of intermediate forms, it would be hard to recognize the Pekinese dog and the St. Bernard as being of the same species. Yet, anatomical difficulties apart, fruitful congress is possible between all breeds of dogs. Still, forms which had been reckoned as true species have been found to produce fertile hybrids, so that we come back again to the difficulty of definition. If the sterility alluded to is the criterion, then the forms just mentioned, which

had been assigned to different species, were wrongly thus assigned. The fact is that there is no absolute consensus on this point, yet implicitly at any rate, as we shall see, the sterility test is commonly accepted. The idea of species itself is not an old one, for Ray, the great English biologist (died 1705), first made the term species definite in zoology and botany, though he seems to have got it from Kaspar Bauhin (died 1624), who was Professor of Greek, Anatomy and Botany (what a combination!) in Basel and the author of an anatomical treatise of some note.

For the idea of specificity, however, which has really been at the root of the evolution discussion, we cannot go further back than Linnæus (d. 1778), whose aphorism in his "Philosophia botanica": "Species tot sunt diversæ, quot diversæ formæ ab initio creatæ sunt," many so-called Fundamentalists have (without the least justification) read into the Bible in their own sense. Probably the question of species cannot be better summed up than it was by Bateson in a letter to *Nature*:[1] "We still await the production of an indubitably sterile hybrid from completely fertile parents, which have arisen under critical observation from a single common origin. All domesticated races (*e.g.*, dogs, pigeons, fowls, peas, etc.), when intercrossed amongst themselves, never produce this sterility amongst their mongrels, though the races are often distinct enough to pass for

[1] July 15, 1922.

species. But, if we begin crossing natural species (even those which on our reckoning must be very closely allied), we constantly find either that they will not interbreed, or that, if they can be crossed, the result is more or less sterile. Dr. Cunningham takes exception to my speaking of this interspecific sterility as the chief attribute of species, but he will not dispute that it is *a* chief attribute of species." It may just be added that the older naturalists like Buffon and Lamarck did allow the objective existence of species, both believing that they might be modified—according to Buffon, by changed environment, or, according to Lamarck, through the inheritance of acquired conditions; and that Cuvier was firm in his belief in species and in their absolute fixity. Then came Darwin and the controversy with which we are concerned.

Of course, there are naturally limitations to change. Aristotle said, in relation to the plasticity of matter, that you could not make a saw from a thread of wool, and the supposed developments must come from forms in near relationship. No one would suppose that the lion was evolved from the cow or *vice-versâ*. Some would confine this possibility within quite narrow limits. For example, that very acute observer of nature, Mr. Shelford, says: "Whole-hearted supporters of natural selection regard variation as indefinite and infinite and only controlled by natural selection; but I am heretic enough

to believe that variation is defined and limited and controlled only partially by natural selection. I regard the lines along which variation in any organism can proceed as limited in number; to use a metaphor, I look on variation as an engine which can proceed only along certain rails; there may be numbers of such rails going in different directions, but the engine cannot get off the rails." [2] It is clear that on these lines we are not far from a theory of interspecial variation leading to the formation, not of new species, but only of varieties—a thing which no one doubts; though where "variety" ends and "species" begins, is a matter over which the wrangles are interminable. A similar view is expressed by Cherry: [3] "The advance of mammalian life is the triumph of specialization. When once specialization is committed to any line of evolution—special teeth or special legs—it must make a success along that line or else it will become extinct. It cannot retrace its steps and begin again." That is what is called Dollo's Law of the Irreversibility of Evolution, which will be sufficiently understood from the above quotation.

And now we must return to the question as to whether we have evidence of any one species having actually arisen from another. Darwin, as is well known, made great use of Artificial Selection, but

[2] "A Naturalist in Borneo," p. 225.
[3] *Science Progress*, July, 1920.

that has never produced a new species, and as a matter of fact tells against his theory in that, however varied the products (as in the case of the very numerous breeds of domestic dog), not only are they all capable of inter-breeding (anatomical difficulties apart), but, if complete promiscuity is permitted, the breeds disappear and the mongrel—the "yaller dog"—emerges.

And above all it is *artificial* selection; there is an artificer in the background, and that was what Darwin was unwilling to admit—or at least his followers were—in the case of what he called Natural Selection. Even the case of the Porto Santo rabbits, which at one time seemed strong, seems to have broken down.[4] In 1418, Zarco, a Portuguese navigator, turned loose on the island of Porto Santo, near Madeira, some wild rabbits which had been produced by a doe that he had brought on his ship. There are no carnivorous birds or animals on that island, and naturally the young rabbits bred and increased freely and by Darwin's time were numerous. Some of them were brought home; were clearly quite different from the common European rabbit (*Lepus cuniculus*), with which they failed to interbreed; and were taken to be a new species which had been formed under the circumstances—or, as Darwin puts it, would have been taken as a new species, had not the actual history been known. Haeckel—of course,

[4] Darwin, "Animals and Plants under Domestication," I, 117 sq.

it might have been expected from him—did claim that they were a new species, and gave it the name of *Lepus Huxleyi.* Huxley had previously named his ill-fortuned inorganic sediment *Bathybius Haeckelii,* and the returned compliment was no more fortunate, for it now appears that the Porto Santo rabbit is identical with the indigenous Lusitanian animal, which is a south European sub-species (to use another tiresome phrase) not known to Darwin. Being a Lusitanian, Zarco had naturally taken with him the local rabbit. Hence the incident loses all importance as an argument for evolution. Bateson, whom I have so often quoted and who was never afraid to speak the exact truth as he saw it, admitted that "we cannot see how the differentiation into species came about. Variation of many kinds, often considerable, we daily witness, but no origin of species." [5]

Then, it may be asked, why all this bother? Was not Darwin's book on the *origin* of species? Yet here you are telling us that no evidence of the origin of one species from another is to be found. Why go any further? That is precisely the position that I find taken up by quite a number of writers, especially perhaps from what is called the "orthodox" ranks. And I have set the above facts down, because I want to emphasize that point from the start. In spite of all this, the problem is still there: Where and how

[5] In his *Address* to the American Association for the Advancement of Science, Dec., 1921; cfr. *Science,* LV, p. 55.

did the new forms, which undoubtedly did arise in the long story of geology, originate? To the solution of that problem science must continue to address her best efforts. In studying it so far, though the answer still eludes us, the number of new and beautiful facts which have been discovered is legion—facts that but for some such stimulus would still remain undiscovered.

That is one effect of the launching of a really fruitful theory, and it is a valuable result. But the real answer to those writers who set down the facts that I have given and then say: "Why worry any more about this evolution nonsense?" is this. We must go on seeking for an answer to the problem. The only line of country at present open is that of evolution, and that path scientists must explore until someone shows them another more likely to lead to the goal which they are seeking. But let us above all remember that, in trying out this theory, we must bear in mind that it is *but a theory*—a working hypothesis, of great practical value as such, but still unproved. We may now proceed to consider briefly the attempts that have been made to solve the problem commencing with Lamarck.

CHAPTER V

J. B. de Lamarck (1744-1829)

Lamarck at first believed in the fixity of species, but later said that nature, having formed the simplest animals, "then with the aid of much time and favorable circumstances formed all the others." And this, as he taught, came to pass by the operation of two laws: (1) use strengthens, and disuse weakens an organ; (2) there is such a thing as heredity, and the effects of use and disuse are heritable. That is a sufficient paraphrase of his views. Thus, he taught that a felt need on the part of an organism would stimulate growth, and thus cause further development. The giraffe is the usual instance, whose neck was lengthened by stretching after leaves on higher branches during a drought; the lengthened neck was inherited and developed, and the result is what we see. Let us be clear on this point, for some, who did not understand him, have ridiculed Lamarck, supposing that the giraffe wittingly strove after the acquisition of a long neck. What Lamarck taught was, that there was an inherent tendency to vary in living organisms; and that stress brought out that tendency in

a direction favorable to the animal. Thus, Lamarck tried to explain the origin of variations, a matter which Darwin took as "given." Lamarck's theory obviously has a metaphysical background, which rendered and renders it anathema to those who regard all metaphysics as "mysticism," and as irretrievably damned when dubbed with that fatal name. Of course, Darwin, though more committed to it at times than he imagined, would have none of Lamarck's theory. Writing to Hooker he said: "Heaven forfend me from the Lamarck nonsense of a tendency to vary," but then Darwin was incapable of philosophical argument, as he admitted himself. To this day there rages a vigorous controversy over the question: "Can acquired characters be inherited?" Not to be tedious, let me quote a very few opinions and those recent ones. In his interesting summary of Evolution as it is now thought of,[1] Dr. Hogben says that, as the heredity of acquired conditions is unproved, Lamarck may be left out of the discussion; and Professor Conklyn of Princeton[2] refuses to accept the idea, because in his opinion the evidence for the inheritance of any domestic modification is very unsatisfactory. Dom O'Toole also says Lamarck's theory is "sound and plausible in all respects save one, namely, the unwarranted assumption that acquired adaptations are

[1] *Discovery*, June, 1924.

[2] "Problems of Organic Adaptation," Rice Institute, Oct. 1921, p. 331.

inheritable, since these, to quote the words of the Harvard zoologist, G. H. Parker, 'are as a matter of fact just the class of changes in favor of the inheritance of which there is the least evidence.' " [3] On the other hand, we have Professor McBride, a man of the first rank amongst zoologists, declaring that Lamarck's doctrine has been submitted to experiment and shown to be true.[4] Why this difference of opinion? It all depends upon the effect produced on the mind by the consideration of certain experiments by Kammerer and others, which have been accepted by some, and rejected by others.[5] It is, of course, impossible to detail these experiments here, but it may just be mentioned that it has been known for a long time that in the "Black Country" of England certain species of moth were turning black. The first black specimens of the Peppered Moth were obtained at Manchester in 1850. The same phenomenon was observed in the Ruhr in Germany as far back as 1880. By rearing caterpillars on plants contaminated with industrial smoke, there have been produced in three kinds of moths black forms, which are quite vigorous and breed true.

[3] "The Case Against Evolution," p. 9.

[4] *Nature,* Jan. 17, 1925.

[5] Since this Chapter was written, Professor Kammerer has committed suicide, and left behind a letter admitting that one of the specimens on which he relied had been "faked," but vigorously denying that he was responsible for the faking. This, of course, leaves the question of his other instances in a highly unsatisfactory condition.

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Moreover, when these are crossed with normal moths, the offspring work out along the lines of Mendel's laws. Yet the puzzling thing is, that, though the observation is undoubtedly important, the facts do not quite fit in with either Lamarck, or still less with Darwin. Perhaps here it may be mentioned that one of the difficulties of text-books today is that, on disputed points, their authors tend to set down whichever view appeals to them as the only tenable view. No doubt that is natural, but it is certainly confusing to the student.[6]

[6] The real importance of the ideas of Lamarck may well be estimated by the fact that Professor Seba Eldridge of the University of Kansas has devoted a large work of over 400 pages to their close consideration. It is the work of a philosopher as well as a biologist, and deserves careful study by all interested in these and other questions, especially vitalism.

CHAPTER VI

Charles Darwin (1809-1882)

With the ill-informed majority Darwin gets the credit of having invented the theory of evolution, but of course he did nothing of the kind. To those who have gone so far in it as the title-page (many know it only from its back), his book is known as "The Origin of Species by Natural Selection," and it is in the latter half of the title that Darwin's contribution is named. Natural Selection is nature's choice from a given group of variations. Herbert Spencer invented the title of the "Survival of the Fittest," and that explains the idea quite well.

The scientific world ran mad over this theory for years, and even Darwin had to warn his too ardent and unphilosophical followers that Natural Selection could not *cause* a variation. It has been admirably said that it can explain the survival, but not the arrival of a variation. In fact, it is a sieve and a sieve only. "Explain the leaves on that tree?" "They are those which the gardener did not cut off when he was trimming it." That explains why there are not more leaves, but not why there are any leaves

at all. Thus, the matter was put by Driesch, and his simile is quite accurate. But there is more to be said on this matter. Darwin relied entirely on small variations with cumulative effect, and that in spite of a warning from Huxley. It was one of the chief matters of criticism by Mivart, and time has shown that his criticism was correct. Thus, in a recent leaderette in *Nature*: "The efficacy of natural selection as the sole originator of species rests on the assumption that small variations in all conceivable directions are continually occurring, and that these variations can be inherited. This assumption, when critically tested as it has been by the 'pure line' investigations, proves to be incorrect." In fact, it may be said that it has been quite convincingly shown that the kind of variations on which Darwin rested his theory do not give the results which he maintained that they would. Thus: "Johannsen's results proved the non-inheritability in the case of beans of those small random variations from the normal in all directions on which Darwin had laid such stress, and these results were independently confirmed by Jennings, who worked on Protozoa, and by Agar, who studied small Crustacea." [1] According to Darwin's theory, we *ought* to have any number of intermediate forms—"missing links"—illustrating the course of evolution, and the fact that he could not supply instances was attributed to the "imperfection of the geological record." Nearly

[1] McBride in *Nature*, Jan. 10, 1925.

three-quarters of a century of intense research has not given us convincing proofs in this direction. "If you can't get them, invent them," was Haeckel's method, and he wrote of Protovertebrates, Protamphibians and other such things, of which none ever existed outside his own imagination so far as we know today. The fact is, that there are no primitive forms uniting the characters of the several classes, and that is one of Vialleton's objections, as we shall yet have to see. Natural Selection again does not account for a whole range of attributes such as those of an æsthetic character. The love of beautiful scenery in man, for example, cannot be explained on utilitarian lines. Quite the contrary, for it may be argued that, whilst he was admiring the landscape, his adversary had an opportunity of despatching him unawares.

"The song of birds, apart from their calls, is also due to the love of pleasure. Several of the forest birds of New Zealand sing softly to themselves, and it is necessary to be very near to hear them. This is, probably, the primitive style of bird melody, and the loud-throated thrush and sky-lark came later. All these songs are the result of pure enjoyment; there is nothing useful in them, so they cannot be due to natural selection." [2] Finally (as we shall see when we come to Mendel), if the views of his followers are correct, there is no room anywhere for natural selection. This explains Bateson's statement: "We go to

[2] Hutton, "The Lesson of Evolution," 167.

Darwin for his incomparable collection of facts. We would fain emulate his scholarship, his width and his power of exposition, but to us he speaks no more with philosophical authority. We read his scheme of Evolution as we would those of Lucretius or Lamarck, delighting in their simplicity and their courage." [3]

In 1907 Professor Vernon Kellog brought out a work entitled "Darwinism Today," in which are set down the amazingly diverse views on almost every point connected with the work of Charles Darwin. Those who consult this interesting work may be informed that the diversity of opinion has not diminished, but rather intensified in the twenty years which have passed since its publication.

[3] Presidential Address to the British Association for the Advancement of Science at Melbourne, Australia, 1914, p. 8.

CHAPTER VII

Other Evolutionary Theories

Haeckel and Recapitulation

That ontology repeats phylogeny—in other words, that the embryological history of the individual is the syncopated history of the race—was the supposedly convincing argument of Haeckel and Fritz Müller, and for a long time it held the field. It is indeed quoted even today by many, but it in no sense enjoys the position which it once did. Kellog [1] says it is "mostly wrong" and "chiefly conspicuous now as a skeleton on which to hang innumerable exceptions." "The Biogenetic Fundamental Law" of its enunciators has also received severe criticism from Vialleton,[2] and especially in connection with the long-famed "branchial cleft" theory, which taught that the human (and other mammalian) embryos went through a fish stage. Now, in the neck

[1] "Darwinism To-day" (New York, 1907), pp. 18, 21. As stated in the last chapter, far from being weakened, Kellog's criticism has been confirmed by more recent investigations.

[2] "Membres et Ceintures des Vertébrés Tétrapodes" (Paris, 1924).

region in the human embryo there do arise a series of ridges and furrows—*not* clefts—in a similar position to that occupied by the gill clefts in a fish. But these never function as gills or anything like them. They are a stage in the production of permanent organs—such, for example, as the ear passage—and of certain glands. They afford, therefore, no certain proof—some would say no proof at all—of evolution, or at least of phylogeny. In this connection perhaps may be mentioned the so-called "rudimentary organs" so much relied on at one time as proofs, which will not be overlooked when we arrive at the question of man.

Weismann and the Germ Plasm

About forty years ago August Weismann of Freiburg-im-Breisgau created a great sensation in the biological world by his very interesting papers.[3] In the first place, he laid emphasis on the non-heritability of mutilations. That hardly required laboring, for Hebrews and other peoples have been practising circumcision for many hundreds of years without producing a race devoid of prepuce. But the main foundation of his system was that there was a fundamental distinction between body cells and germ cells; that the latter were early cut off from the former, and segregated apart from the

[3] "Essays upon Heredity" (Eng. Trans., 1889) and "The Evolution Theory" (2 vols., Eng. Trans., 1904).

general influences which might affect the body; and hence that the inheritance of acquired characters was an impossibility. In order to account for variation, since the environment could not produce it *ex hypothesi,* he built up a theory of intracellular selection based on a hierarchy of "ids" and other elements in the germ cells. We need not delay over this, for his elaborate theory never received substantial support, and the experiments of Driesch and Hertwig on segmenting eggs have practically demolished the specific germ-substance idea. Still, the whole episode is worth recalling, since for a time it was almost heretical to doubt the Weismannian ideas. The shifting character of scientific opinion is well exemplified here.

De Vries and Mutations

Bateson first of all expressed the theory that evolution took place by mutations or "sports" (a word more commonly used); that is, by those large and considerable variations which Darwin (contrary to the advice of Huxley, who was more clear-sighted) had utterly rejected. But it was the work of the Amsterdam botanist, De Vries, on *Œnothera Lamarckina* (the Evening Primrose), that really brought the question into the arena.[4] In his "Materials for the Study of Variation" (1894), the

[4] "Species and Varieties" (Chicago, 1905).

motto of which is: "All flesh is not the same flesh; but there is one kind of flesh of men, another flesh of beasts, another of fishes and another of birds," Bateson made a completely new break in evolutionary controversy, declaring first of all that variation is evolution (which is admittedly true), and secondly that "discontinuity of species is due to the discontinuity of variation," and that is the doctrine of De Vries. The Mendelian discoveries seem to chime in with this idea, and the combination is so strong that in 1925 Professor McBride said that this joint teaching "became the dominant doctrine of evolution and heredity for most of the first quarter of the twentieth century, and probably counts amongst its adherents a larger number of biologists than any other doctrine at the present time." Two years ago Millis, a distinguished botanist, published a work called "Age and Area," in which he supports the idea that species originate in sudden inexplicable jumps which occur only rarely. That idea, says McBride, "is difficult to distinguish from the pre-Darwinian doctrine of special creation." It may be added that Haeckel said of Bateson's book, which appeared during his lifetime, that "if views like this are to be accepted, it would be better to return to Moses at once." A fine example truly of the open mind advised by scientists for others and *à fortiori* for themselves, as are even Alfred Russel Wallace's letters on "Mendelian and Mutational absurd

claims"![5] Of course, like every other doctrine, there is strenuous conflict over this combined theory, but many if not most biologists are inclined to subscribe to it, and those who would like to see a concise expression of opinion on the subject may be referred to a lecture by Ruggles-Gates.[6]

[5] "Letters and Reminiscences," pp. 333 sq.
[6] *Nature*, April 4, 1925.

CHAPTER VIII

Mendel and the Modern Mendelians

The work of the Abbot of Brünn is undoubtedly the center of biological theory today. It is impossible here to enter into the details of his discoveries, but it may be said that for the first time they revealed certain *laws* of heredity. Before Mendel we knew that there was such a thing as heredity; he taught how it went to work.[1] His papers lay neglected for sixteen years; then they were discovered by three men of science simultaneously, and the whole biological world was in a tumult. There is this to be said *in limine*. Mendel's facts have been verified time after time and in all sorts of directions. There can be no doubt about them, and Mendel can never, therefore, be deposed from his pedestal as mere theory-makers have often been. The deductions from these facts are largely those of workers along the lines which he laid down, and were unknown to him. Hence, if they break down,

[1] "Mendelism" by Punnett is the best small work on the subject. A sufficient account of this and of the other evolutionary theories will be found in the last edition of my book, "The Church and Science."

his is not the discredit; if they make good, it is certain that they could never have been put forward but for the man whose discoveries have been placed on a level with those of Newton and John Dalton. It is very important to distinguish between a fact and a theory, as I have tried to show in one of my books, and to bear in mind what is the share of Mendel and the Mendelians in the present state of the doctrine. Put as briefly as possible the point is this: Darwin and the Darwinians held that the hypothetical primordial cell on which evolution was to work was simple—comparatively speaking, of course. The Mendelians—but not Mendel, who never mooted the idea—hold that the original cell was of enormous complexity; that evolution has taken place by the gradual loss—not gain, as under Darwinian teaching—of factors that by their inhibitory power had prevented tendencies, which were there all the time, from coming into operation. A boy at school may be cowed by a bully, and appear in quite a different light after that bully has been got rid of.

Hence, Bateson taught that no new thing ever was introduced in the process of evolution, and his view was summed up by a wit who said that Adam was a simplified amœba, and that the stages between the two were merely the result of the taking out of safety-pin after safety-pin. Thus, Darwinians do the sum of evolution by addition, Mendelians by subtrac-

tion. Both, no doubt, are evolutionary methods, but both cannot be true. Which is? There have been heated contests over that question and the end is not yet, but it will be easily understood why a very distinguished biologist said that Mendel had given the *coup-de-grâce* to Natural Selection. In fact, if the extreme Mendelian view is accurate—though it is a large morsel to swallow—the influence of the environment and the heredity of acquired characters and other matters discussed here sink into the background. On the other hand, the sudden dropping out of an inhibiting factor may easily account for a mutation. One important point about Mendel's discoveries is, that they reveal *laws,* and laws cannot be without a lawgiver, as Plate admitted in the Berlin debate with Wasmann.

"With the experimental proof that variation consists largely in the unpacking and repacking of an original complexity, it is not so certain as we might like to think that the order of these events is not predetermined." [2] It is difficult to see why we should like or not like any scientific fact, if we are free from *parti pris.* But it is surely clear that, if the process is as indicated, there must have been an original packing, marvellous beyond anything that the mind of man can imagine. As to the unpacking and repacking, one cannot here say more than that it is at least possible through the remarkable performances of the

[2] Bateson in "Darwin and Modern Science," p. 101.

chromosomes (or fragments of living substance in the germ cells), which seem to carry the hereditary traits—of a Mendelian character, at any rate.[3]

[3] See Morgan, "The Physical Basis of Heredity" (Lippincott, 1919), not an easy book by any means. "Mendel's Principles of Heredity" by Bateson (Camb. Univ. Press) gives the actual papers in translation with much other matter, and is the standard work in English. These details are given, because the whole topic of Mendel is of such absorbing importance at present.

CHAPTER IX

Bateson, Discontinuity and Mendelism

Bateson has been so frequently quoted in these articles that it might seem hardly necessary to say anything more about him. But, for various reasons, there are today few more significant names in the evolution controversy; hence it may be well briefly to indicate what he stood for.

And, to begin with, one may remind oneself that it was his utterance which set a match—as he himself said—to the evolutionary conflagration in the United States. Still earlier his teaching as to discontinuity brought about a great change in thought. He urged that there were two facts that constitute the problem which evolution proposed to solve: (i) the forms of living things are *various*, and, on the whole, are *discontinuous* or *specific;* (ii) the *specific* forms, on the whole, fit the places they have to live in.[1] How, he asks, have these discontinuous forms come into existence, and how have they come to be thus adapted? It is the problem in a nutshell. Thoroughly dissatisfied with the Darwinian solution,

[1] "Materials for the Study of Variation," p. 3.

he was one of the first and always the most active exponent of Mendelian ideas; and, as head of the experimental station in England, carried out himself and by his pupils a vast number of experiments on those lines. In America Professor Morgan of Columbia and his pupils have laid the scientific world under an equal debt. Bateson was the chief supporter of the view that the evolutionary sum was done by subtraction. In his British Association Address already mentioned, he said that there was "no evolutionary change which, in the present state of our knowledge, we can positively declare to be not due to loss." Note the cautious character of the statement. Further he declared that it was "the gradual loss of inhibitive genes [*i. e.*, packets of germinal matter], whose elimination releases suppressed potentialities." His last published utterance, which appeared after his much to be regretted death,[2] shows that he not only had a very open mind, but could be and was careful in distinguishing between facts and hypotheses.

This article deals with the chromosome question. These packets of germinal substance have been hailed by some as the carriers of the hereditary characters, and it seems clear, as he admits, that it has been proved, especially in animals, that *some* transferable characters have a direct association with particular chromosomes. But he refused to admit that this fact

[2] *Journal of Genetics*, Jan., 1926.

permitted the extension to a comprehensive theory of heredity through the chromosomes. And he sums up by saying that "the chromosome theory, though providing much that is certainly true and of immense value, has fallen short of the essential character." Again, as pointed out previously, readers will note the radical differences of opinion amongst men really qualified to speak on these subjects and the state of complete uncertainty in which even very fundamental questions still remain.

CHAPTER X

The Morphological Argument

There is no question but that this is the center of the whole matter, for it is on this that the theory of evolution in the end rests. Yet no one who has not himself worked practically along morphological lines can possibly appreciate the urgency of the facts. Vertebrate morphology for years absorbed my attention, and I can testify to the truth of what I have said, and I shall try to set down fairly the evidence for and against.

It will take some space, but it is worth while to understand this point, since it is absolutely fundamental. "What is formal morphology?" asks that distinguished botanist, Professor Bower,[1] and replies: "the comparative study of form. Without this there can be no argument for evolution, for form is the visible record of what physiology does, and without that record argument on evolution would be impossible."

Let me explain what is meant. Take the vegetable

[1] *Nature,* March 8, 1894.

kingdom: the majority of plants, speaking generally, are built up on similar lines, having roots, stem, leaves, often flowers and fruits. Further, their minute anatomy is on more or less identical lines. Go to the animal kingdom and much the same is to be said. Take the enormous group of mammals, all with four extremities, a backbone with elements all built on the same plan; with arterial, venous, nervous, above all muscular and osseous arrangements all on the same lines. Is it not impossible not to feel that such a state of affairs is due to common descent? What is the alternative? Is it not the creation of a number of species all on the same lines, yet in no way related to one another save that all came from the fiat of the same Creator? And does not that seem to sin against the idea of economy? This is the idea which is at the back of the saying of Fr. Wasmann that the billiard player who can send one hundred balls to their desired positions by one stroke displays more skill than he who requires one hundred strokes to achieve the same end. No Theist doubts that the Creator could have worked along the lines suggested in the second alternative; yet can we really imagine such a thing? Frankly I find it difficult to do so, whilst freely admitting that what I find difficult to realize may yet have been the case, for I equally freely admit that the morphological facts do not amount to an absolute demonstration. In fact, I agree entirely with the statement made by Professor

Morgan of Columbia University.[2] He is discussing how far the evidence from comparative anatomy can be used as an argument for evolution, and he says: "It is the resemblances that the animals or plants in any group have in common that is the basis for such a conclusion; it is not because we can arrange in a continuous series any particular variations. In other words, our inference concerning the common descent of two or more species is based on the totality of such resemblances that still remain in large part after each change has taken place. In this sense the argument from comparative anatomy, while not a demonstration, carries with it, I think, a high degree of probability."

Professor McBride[3] says that the facts drawn from comparative anatomy, embryology and palæontology are those on which the theory rests. The first have just been indicated; the second were dealt with very briefly in Chapter VII, and space forbids further discussion; the third remain for consideration and in close relation with morphology. Huxley[4] said that "primary and direct evidence in favor of evolution can be furnished only by palæontology." Professor More[5] says that evolution but for this science might have been a guess of fancy, but could never have been brought forward as a scientific theory.

[2] "A Critique of the Theory of Evolution," 1916, p. 14.
[3] *Nature*, Jan. 17, 1925.
[4] "Collected Essays," II, p. 239.
[5] "The Dogma of Evolution," p. 120.

But the passage deserves textual consideration. "Without such a palæontological record our only sources of proof would have rested on our reluctance to accept the special creation of each species by a divine Creator; on the fact that species are so numerous and so complex that we cannot classify them; on the fact that we can cause animals and plants to vary by selective breeding; and, lastly, because we have found that an embryo goes through a series of structural changes which apparently connects different species. The first source is purely a matter of temperament, as we certainly cannot deny the power of a Creator to act; the second is merely a question of the number of existing forms and their complexity of structure, as no one supposes that evolutionary links connect two species by existing intermediary forms; the third source does show us that variation is the law of life, but it also points to the persistence of species even more strongly than to their variation, since with all our contriving we have never been able to produce a new species, and reversion to the common type occurs when indiscriminate breeding takes place; and lastly, embryology may show relations and connections between different types, but we cannot argue that, for example, a mammal had a piscine ancestry because at one stage its embryo has a gill organ instead of a lung." [6] When we direct our attention to

[6] Which, as shown above in Chapter VII, is putting matters more strongly than the facts warrant.

palæontology, we must beware of the too confident statements of some writers, here as elsewhere, in the vast field of discussion. Take one example. In a paper[7] designed to show how the changes *might* have come about, Professor Goodrich says: "We are all agreed that the four-footed terrestrial vertebrates or *Tetrapoda* have arisen from some fish-like aquatic ancestor." First of all, who are "we"?—for there are scientific men, like Vialleton, who do not take this view at all, and he is an authority on the Tetrapodal limbs. Here, as so often, "we" means "I", and why do "I" think it? Because, *if* the theory of evolution is true, I see no other way of accounting for the existence of four-footed terrestrial beasts today. That may well be, but hear Professor More on this point.[8] "One of the greatest steps in evolution occurred when amphibians with feet and legs and with an air-breathing apparatus appeared in the Carboniferous age. It is customary to assume that these animals developed from fish, which lived in such shallow water that they were driven to adopt land locomotion and life because of the lack of food. But we have no relics of amphibians in a transitional state in the sub-Carboniferous age." And he quotes from Chamberlain and Salisbury: "Relics of amphibians appear only in later Coal Measures. They were already differentiated into five sub-orders." Further, he

[7] Brit. Assoc. Meeting, Toronto, 1924.
[8] *Op. cit.*, p. 154.

points out that the positive evidence of the alleged change is derived from six footprints found in Pennsylvania—surely a very slender basis of proof for so momentous an assertion! Does it justify us in being "all agreed"? It hardly seems so. Let us turn to the statements of palæontologists for a few moments. Professor Bather of the British Museum is a first-class authority, and he [9] told his assembled brethren that "the palæontologist cannot assist at even a single birth" (*i. e.*, of a new species). Hence, from his point of view, "the evidence remains circumstantial." Moreover, in this very interesting Address, he laid stress on a point which eludes most persons, especially perhaps visitors to museums where are to be seen nicely graded series of skeletons showing the "evolution" of the horse or the camel or man. There is an underlying assumption in every one of these cases—an assumption that is absolutely unprovable. It is that Grade B, which appears to be a slight advance on A, is actually related genetically to that grade. If it is not, then there is no evolution. "Let us suppose," he said, "all written records to be swept away and an attempt made to reconstruct English history from coins." We could set out our monarchs in true order, and we might suspect that the throne was hereditary; but, if on that assumption we

[9] In his Address to the Geological Section of the Brit. Assoc., 1920.

were to make James I the son of Elizabeth, it is certain that we should be wrong, and so may those phylogenists be who make these neat genealogical trees. Take the horse pedigree made so famous by Huxley and vaunted in many a little manual as a conclusive proof of evolution.[10] This scheme, says Bather, has had to be corrected in the light of fuller evidence. "Palæotherium, which Huxley regarded as a direct ancestor of the horse, is now held to be a collateral, as the last of the Tudors were collateral ancestors of the Stuarts. The later *Anchitherium* must be eliminated from the true line as a side branch—a young Pretender. Sometimes an apparent succession is due to the immigration of a distant relative from some other region—'the glorious House of Hanover and Protestant Succession'." The lesson of all this is, that *succession does not prove genetic connection,* and with that fact collapses all hope of demonstration through these misleading series of fossils. Unless you can prove their genetic connection, you get nowhere. Turn now to the vegetable kingdom. Carruthers, a very first-class authority in his not very distant day, in a Presidential Address to the Geologists' Association half a century ago (1875),[11] said that "the complete absence of

[10] "This great service, the affording of unquestionable proof of this momentous theory [of evolution] mankind owes to its trusty servant the horse," is the rubbishy statement in one of these misleading works.

[11] I do not know of any conclusive evidence since to negative his assertions.

intermediate forms, and the sudden and contemporaneous appearance of highly organized and widely separated groups, deprive the hypothesis of genetic evolution of any countenance from the plant-record of these ancient rocks. The whole evidence is against evolution, and there is none for it." Take a later authority, Zeiller, who is said by Scott [12] to be one of the two greatest authorities on the succession of plant species. His views are set forth very clearly, [13] and are as follows: (i) From the beginning, the groups of the vegetable kingdom are sharply separated as they are now, and there are no passage forms; (ii) The same is true of classes, orders, families and generic types; (iii) Variations within limits occur no doubt, but do not cross the boundaries which separate even the most neighboring types; (iv) Discontinuity is most accentuated in the highest groups. Of course, these statements are met with the old reply respecting the imperfection of the geological record, but Torrend in the article from which the quotation is taken pretty conclusively disposes of this argument. There remains another line of argument based on the phenomenon of convergence, by which is meant the occurrence in wholly distinct groups of highly similar forms. Thus, there are two great groups of mammals, placental and non-placental, which even the most ardent evolutionist

[12] "Darwin and Modern Science," p. 222.
[13] In "Études sur le Darwinisme," 275 n.

would only connect at the very commencement of the mammalian series. The latter appears to be the earlier, and includes forms like the kangaroo and others in Australasia, where, with the exception of the raccoon, they alone are to be discovered. Now in both these classes are to be found ant-eating forms; burrowing forms with large and with small eyes, and so on. This great similarity without any possible genetic relationship certainly makes it very hard to sustain another underlying assumption of all phylogenetic proof—namely, that resemblance implies relationship, if it does not predicate it. Still there remains, apart from any palæontological complications, the morphological argument as stated above, and even that does not convince Vialleton, who is undoubtedly one of the best morphologists of the day. And what is remarkable is this: in his earlier works he proclaimed himself an evolutionist and based his findings on that teaching, and now in his later work, quoted above, he discards that standpoint altogether. Evidently Morgan is right that the morphological argument is suggestive, and it is that unquestionably, but not demonstrative. Yet it is indisputably the *cheval de bataille* of evolution. How then can that theory be talked about as *proved,* as it constantly is? Only by using the word "proved" in a totally false sense.

CHAPTER XI

Self-Sufficiency or "Orthogenesis"

Our last chapter referred of course entirely to that type of evolutionary philosophy which confines its horizon to small variations, with the corollary of "links"—which are so usually, as we have seen, "missing." If we come to the mutational idea (that is, progress by considerable jumps), we are in a totally different country which opens up vistas which must be carefully examined. In an Address delivered at St. Louis, Mo., in 1904, Smith Woodward, one of the leading geologists of the world, said: "It must now be confessed that repeated discoveries have now left faint hope that exact and gradual links will ever be forthcoming between most of the families and genera. The 'imperfection of the record,' of course, may still render some of the negative evidence untrustworthy; but even approximate links should be much commoner in collections than they actually are, if the doctrine of gradual evolution were correct. Palæontology is clearly in favor of the theory of discontinuous mutation or advance by sudden changes." Of course, those who do not like

this attitude have their replies. There is no great range of mutational changes known to us, though they are increasing in number, and they are mostly in the vegetable kingdom. There is one obvious answer to that. The appearance of a mutational species can only once in a while be noted, when it occurs in a carefully observed plot of land (dealing now with vegetables). The new *Chelidonium Laciniatum* would never have been recognized as coming from the old *C.majus,* if it had not appeared in an apothecary's garden, and if the apothecary had not had sufficient scientific bent to go thoroughly into the matter. Nor would the Irish Yew ever have been detected as a mutation, but that it arose in a gentleman's garden in the County Fermanagh some hundred years ago. There may have been hundreds of such occurrences in wild nature with no one to detect them. Nor could their results be detected, for the essence of the mutation is that there are no links. The mutation theory thus places the evolutionary proof from palæontology on a different footing—but again, it must be admitted, on one of pure surmise. The occurrences might be explained by mutations. They might, but are they? Because an explanation explains or would explain, it is not, therefore, necessarily the true explanation. The mutations or jumps are jumps forward following Dollo's Law, for there is never a jump back. What causes this? To everybody who thinks it must be clear that *evolution along*

whatever lines, if it exists, is not a self-explanatory process. Only the muddled thought of the age can imagine that such a system could come into operation just anyhow, and carry on along the same lines. An explanation had to be sought, and today many find it in the blessed word, *orthogenesis.* This is a theory worth careful consideration. The term we owe to Naegeli, the only scientific correspondent, so far as we know, whom Mendel ever possessed. By that term he meant that there was a factor, *not material,* within the organism which urged it on to its perfection, and the species along a line of further development. Korschinsky [1] puts it that "in order to explain the origin of higher forms out of lower, it is necessary to assume in the organism a special tendency to progress."

I need not point out to the readers of these articles that, when we arrive at this point, we reach the hylomorphic theory of Aristotle and St. Thomas—in other words, it is a kind of re-discovery of Aristotelianism, for there is no reason to suppose that any of these scientific writers knew anything of the Peripatetic philosophy. This suggestion simply infuriated the anti-metaphysical wing, as may be seen from the following quotation: [2]

"It is needless to say that few biologists confess to such a belief. . . . Such an assumption of a mystic,

[1] Cfr. Kellog, "Darwinism To-day," p. 278.
[2] Kellog, *loc. cit.*

essentially teleologic force, wholly independent of and dominating all the physico-chemical forces and influences which we are beginning to recognize and understand with some clearness and fullness—such a surrender of all our hardly won actual scientific knowledge in favor of an unknown, unproved, mystic vital force we are not prepared to make. As Plate well says, such a theory of orthogenesis 'is opposed, in sharpest contrast, to the very spirit of science.'" What an example of confused thought! The spirit of science is to find out what and how things are, and not to adopt the *parti pris* that everything can be explained in the terms in which we think that things ought to be explicable—or, for the matter of that, any other *parti pris*. And, as to "surrender," if what you hold is untrue, how, in the name of science, can you continue to hold it; and, if it is true, who is going to ask you to surrender it? However, logic will tell in the end, and only recently, in response to my question as to whether he did not think that orthogenesis was gaining ground, a very distinguished man of science replied that *he did not see how any rational man could hold any other view.* For a further instance of the advance of this view, let me quote a casual remark from a paper on the growth of the spicules in sponges by Professor Dendy (author of that well-known book, "An Outline of Evolutionary Biology"), recently published in the Proceedings of the Royal Society of London:

"We seem to have here, however, a very good example of orthogenesis, or evolution in a determined direction." *Determined*—there is the kernel of the whole matter—by what? By orthogenesis or the inbiding principle? But that is not self-explanatory, and we are irresistibly led to seek the originator of this principle, and thus reach the Creator and Sustainer of all things. Herbert Spencer substituted for personal guidance by will and intention an atomic and mechanical operation amongst things themselves (as Sir Oliver Lodge has recently been pointing out), but with no success, for such a scheme, like all mechanistic schemes, will not act. The very advance of our knowledge of matter and of its nature, as someone has recently said, has killed the old materialism. "There is no mechanical explanation for the ultimate mechanism of the universe; mechanism cannot explain itself." [3]

Go back to Kant, the prophet of the period of materialism in England, and hear what he says: "We may boldly assert that it is absurd for man . . . to hope that a Newton may one day arise to make even the production of a blade of grass comprehensible, according to natural laws ordained by no intention."

The fact is that, though many evolutionists would not allow wild horses to drag such an admission from them, their theory can only begin to work if and

[3] Conklyn, "Problems of Organic Adaptation," p. 371.

when they recognize it as a method of creation. Then all the difficulties discussed (and others undiscussed here) disappear—*e. g.,* the question as to where life came from into a world which at one time would not permit of its existence. The questions of the appearance of sensation and consciousness made A. R. Wallace see that you must bring a Divine influence into the system which he and Darwin pressed upon the world. "Given a Divine Intelligence to guide organisms, as man directs those in a domesticated state, and the problem is solved, but that is the last admission the scientific evolutionist is prepared to make; he will only admit nature and natural law, whatever these words may mean." [4] And, as the writer might have added, such an evolutionist cannot see that his "nature" and his "natural law" are not self-explanatory. The fact is that, if scientific writers who refuse this solution would devote some little time to the argument *a contingentia,* and meditate over St. Thomas's *Quinque Viæ,* they would see that to talk of nature and natural law as final explanations is to talk nonsense. It ought not to be necessary for me to say that it is on lines such as this that Catholic evolutionists find no difficulty in accepting the theory—even as proved, as Canon de Dorlodot thinks it is, but much more as the most satisfactory working hypothesis at present before the scientific world, as the present writer does.

[4] Moore, "The Dogma of Evolution," p. 216.

CHAPTER XII

Man's Body

I AM not going to discuss the topic of man's soul; it is unnecessary here, for we know that it is a special creation by God. The extreme evolutionist will have none of this, and the "behavioristic" psychologist is all in favor of his view. I confess that it is utterly impossible for me to understand how these people reconcile their ideas with patent facts, but space prevents me from proceeding with this matter; let us turn to the minor question.

In his work entitled "Apologetics and Catholic Doctrine" (II, 55), Archbishop Sheehan declares: "If the proof were forthcoming tomorrow that the body of the first man was evolved from the lower animals, it would not be found to contradict any solemn, ordinary, or official teaching of the Church. . . . As long as Evolution remains an unproved hypothesis—if present indications be trustworthy, the prospects of its ever rising to the plane of demonstration are exceedingly remote—Catholic teachers will accept the traditional and obvious interpretation of the second chapter of Genesis, that the body of

Adam was created directly by God. In thus following the immemorial practice of the Church, never to reject the old in favor of the new and unproved, their action must commend itself as reasonable and prudent even to those who are not of the faith." The Bible tells us—as the Vulgate puts it—that God made the body of man *de limo terræ,* and what that *limus terræ* was, the Church has never defined. St. Augustine warns us that to talk as if God, *manibus corporalibus,* modelled a figure from clay is *nimis puerilis cogitatio.* What is man's body? It consists of from twenty to twenty-five of the commonest elements of the earth's crust, plus a very large quantity of water—thus being veritably *limus terræ,* like the bodies of all animals.

In that sense no one can deny that God has made our bodies *de limo terræ,* but the prevalent idea of evolutionists is that man's body came only ultimately *de limo,* but proximately from the body of some animal—the hypothetical "anthropoid ancestor." Darwin held that this was an ape; others believe in a common far-back ancestor from which, on divergent lines, proceeded men and apes. Others fancy a lemuroid ancestry; others again have in their mind's eye a plantigrade beast by the seashore, not an arboreal fruit- and nut-eating beast. To read the books on the subject, one would suppose that there was no more doubt about the animal origin of man's body than of the existence of an atmosphere around

us. But exact proof is lacking, and the assumption is made along the lines of morphology. I entirely agree with Dom O'Toole that, on morphological lines, there is no stopping at what he calls "Wasmann's Comma," for that learned Jesuit, whilst accepting evolution for lower animals, drew the line at man. If one accepts the morphological argument as conclusive for the animal kingdom generally, it is hard to see how Wasmann's line can be drawn; for man, save for certain small though important exceptions, is anatomically an anthropoid, and the arguments already cited apply here as well as there. The other arguments brought forward in the past are those from embryology, which have been discussed and are suggestive but not conclusive. Then there is the "rudimentary structures" argument, which is much less powerful than it was, since objects like the pituitary body, for example, once thought to be rudimentary and useless, are now known to be of the first importance to the body as the producers of internal secretions or hormones. Even the vermiform appendix, which is so much insisted on as such, is in my opinion no real help to the argument, for I agree with those who think that so richly lymphoid an organ must have its function, and compare it with the tonsils in the pharynx. Man can get on without it, it is true, but then he can get on without his tonsils or his colon, or one of his kidneys or other vastly important organs, so that the argument fails there. In a word,

whilst the facts are strongly suggestive, they do not amount in any way to a demonstration. Nor do those drawn from palæontology. It is quite impossible to discuss the cranial remains, on which so much theory has been built, but one quotation from an undoubted authority who anticipates that proof along these lines will yet be forthcoming may be cited.

Dealing with this question Marcellin Boule, a first-rate authority, says: "We must confess then, however damaging the confession to our *amour propre,* that we are still too ignorant to give a direct answer to Huxley's 'supreme question' or to solve in full the perplexing problem of our origin." [1] Branco and others, like Reinke, declare that science knows nothing of the pedigree of man, and there we must leave this question still unsettled.[2]

But there is one undoubted fact of which we may make a mental note in the midst of our uncertainties. Whatever the actual status of the former possessor of the fragments found at Trinil and dignified by the name of *Pithecanthropus-erectus,* or of the owner of the Heidelberg jaw, or of other much disputed bones of contention, it is quite clear that at an earlier time of the world's history there were in existence either beasts which were much more manlike than any now known or men much more simian in struc-

[1] "Fossil Men" (Eng. Trans., 1923).
[2] The matter is much more fully dealt with than is possible here in my "Church and Science."

ture than any living races of mankind. For a solution of these difficulties we must await further discoveries.

One final word on this important question. If man's body was evolved from some animal form, it must have been either by small gradually accumulating changes or by a mutation. I regard the former, which has been usually accepted tacitly at any rate as the method as impossible for reasons given in full by Dwight,[3] namely, that as that process was a retrograde one *quâ* strength, swiftness of foot, capacity for climbing and the like, the developing being would have been wiped out of existence by his fellows. A mutation, which on other grounds is much more likely, does not present these difficulties. But the fact that the evolution occurred by a mutation—if it did—can never be proved, since, as already shown, there can be no links to show us what had taken place.

[3] "Thoughts of a Catholic Anatomist," p. 158.

CHAPTER XIII

Epilogue

Of course, the Catholic outlook on the Bible narrative is wholly different from that of the world around us. Elsewhere we find it either neglected (as it is by some) or twisted to suit one's own ideas (as it is by others), or again taken absolutely literally, as the old Scotchwoman is reported to have said that she believed every word between the two covers, which in her case would have included the fulsome flatteries of James I (a mass of meannesses and worse) and Elizabeth (no paragon amongst women), not to speak of Bishop Usher's chronology—a brush with which we are often most unfairly tarred. That is the Fundamentalist attitude and for obvious reasons a very dangerous one, and it is from such persons that there arise jubilant cries when any fact or argument emerges which appears to be antagonistic to evolution.

Now, to begin with, Catholics do not hold, and never have held, that the Bible is a text-book either of history or of natural history, but a book given us to make us aware of God's creation of the universe

and of His dealings with mankind, and for the purpose that mankind may find their way to be with Him forever. Hence, Catholics are not surprised to find that in order to reconcile the two books of God, Revelation and Nature, it may be necessary at times to understand some of the passages in a figurative manner. Of course, the figurative passages must be limited to those falling under the category above alluded to, but St. Thomas Aquinas puts the whole thing in a nutshell when discussing the work of the "second day" of creation, where he says: "In discussing questions of this kind two rules are to be observed, as Augustine teaches. The first is to hold the truth of Scripture without wavering. The second is that, since Holy Scripture can be explained in a multiplicity of senses, one should adhere to a particular explanation only in such measure as to be ready to abandon it, if it be proved with certainty to be false; lest Holy Scripture be exposed to the ridicule of unbelievers, and obstacles be placed to their believing."

From this it follows that the jubilant anti-evolutionary cries mentioned above should never under any circumstances whatever come from the Catholic ranks. Of all people we can afford to survey this scene of conflict with complete calm, for we know that God's two books of revelation and nature cannot possibly contradict each other. Hence, as Leo XIII told us and as common sense dictates, we should rejoice

in any new discovery whether it tells for or against evolution, for example; for the truth is what we are looking for, and not victory over our supposed antagonists. The fact is that this exultation on the part of anti-evolutionists just alluded to leads their opponents very naturally, and very logically too, to conclude that these would-be defenders of religion believe that the establishment of evolution as a fact would mean the destruction of Christian faith, whereas nothing could be more untrue or more ridiculous. Of course, I am talking all the time of *physical* evolution, and not of the absurdities of "spiritual" evolution. Let me take a parallel case. I have met people who quite seriously believed that if Spontaneous Generation were to become a proved fact—as it may be, though there is no sign of such a thing even on the horizon—the bottom would be knocked out of religion. Such persons are wholly unaware that the whole Christian world held that doctrine for centuries without turning a hair. St. Thomas held it, and only differed from Avicenna concerning it, because he declared that living came from not-living matter by the virtue of powers placed in the latter by the Creator. If Spontaneous Generation were to become a proved fact, the Catholic response would be: "How interesting, and how delighted St. Thomas Aquinas would have been could he have been told that!" Similarly, if physical evolution ever becomes a demonstrated fact, the instructed

Catholic would only need to reply: "How interesting, and how delighted St. Augustine of Hippo would have been if he could have been told that!" That is the attitude which, if I may venture to say so, should be ours: interest in the progress of discovery, whilst the matter is, as it now emphatically is, unproved; indifference as to whether it ultimately turns out that this was or was not the method employed by the Creator for working out His plans.

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